Status and distribution of Black-necked Crane (*Grus nigricollis*) in India

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Abstract: In order to understand and monitor the status and distribution of the Black-necked Crane (*Grus nigricollis*) in India, we carried out systematic long term yearly surveys between 2000 and 2014 at all previously known locations as well as attempted to explore new areas. In this paper, we have summarized the distribution and status of the species in its historic range based on the literature and data collected during surveys in Jammu & Kashmir and at few locations in Northeast India. This paper presents a detailed account of the current status and distribution of the Black-necked Crane in India. The present study is first of its kind which monitored the Black-necked Crane population in India for a period of 15 years. During the entire study period, a maximum of 139 birds were recorded in breeding areas in Ladakh in 2012, and 11 wintering birds were recorded in norteast India in 2006.

Keywords: Black-necked Crane; High altitude wetland; Ladakh; Northeast India; Sikkim

印度黑颈鹤现状与分布

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摘要：为了弄清和监测印度黑颈鹤 (*Grus nigricollis*) 的现状与分布，作者于 2000－2014 年开展了长期研究。每年在所有已知的黑颈鹤分布点开展调查，同时探索了新的区域。基于黑颈鹤的历史分布区，包括查谟和克什米尔、锡金等的文献记载和调查，该文对印度黑颈鹤的现状与分布进行了综述，详细列出了黑颈鹤在印度的当前现状与分布。首次对过去 15 年来印度黑颈鹤种群状况进行了报道：整个研究期间，于 2012 年在拉达克的繁殖地最多记录到 139 只黑颈鹤个体，于 2006 年在印度东北部记录到 11 个越冬个体。

关键词：黑颈鹤；高海拔湿地；拉达克；锡金

中图分类号：Q959.7；Q958.1 **文献标志码**：A **文章编号**：2095-8137-(2014)s1-0039-12

Initially, between 1919 and the first half of the 20th century, the information on the status and distribution of the Black-necked Crane in India was mainly collected by naturalists and travelers and hence it was scanty. Later, few more efforts were made by the scientific community to gather systematic information. Surveys were conducted at several known locations of the species to assess the status and new areas were explored to document the distribution. Today, substantial information on the status and distribution of the species is available in the form of individual reports and published accounts. The available information however, pertains either to a particular region or site(s) where investigations have been made by an individual researcher and hence there is still a lack of a complete and detailed document on the status and distribution of the species in India. Considering this we attempted to collate all available information on status and distribution of the Black-necked Crane in India, so that a clear picture can emerge on the subject and gaps in knowledge can be identified. In order to understand and monitor the status and distribution of the Black-necked Crane in India, we carried out systematic yearly surveys between 2000 and 2014 at all previously known breeding and non-breeding locations as well as attempted to explore new areas. In this paper, we have summarized the status and distribution of the species in its historic range based on the literature and data collected during surveys in Jammu & Kashmir and in selected valleys of northeast India.Currently the total breeding population of the Black-necked Crane in India is more than hundred birds which include 15−20 breeding pairs. As per our latest survey the total non-breeding or wintering population in India is less than 10 individuals recorded only in the Pangchen and Sangti valleys of Northeast India.

STUDY AREA AND METHODS

Study area

The present study was conducted at four locations (Ladakh, Pangchen valley, Sangti valley and Lhonak valley) in Western and Eastern Himalayas in India. The major part of the study was conducted in Ladakh, Jammu & Kashmir in an area of about 22,588 km^2, located between N32º25′ to 34º35′ and E77º30′ to 79º29′ in the Trans-Himalayas. The area lies in the eastern part of Ladakh in Jammu & Kashmir state of India and commonly known as Changthang. This area was declared as Changthang Cold Desert Wildlife Sanctuary (hereafter referred as Changthang) in 1987 by the state Government of Jammu & Kashmir in order to protect endangered wildlife species and their habitat. Changthang is bounded by Zanskar mountain range in the south west and by Karakoram Range in the north west. To the east it is contiguous with Tibetan portion of Changthang which is the western most extension of the Tibetan plateau. The western limit of Changthang follows the boundary of the Nyoma subdivision of Leh district until it meets the Shyok River. The climate of the area is characterized by extreme variations in temperature coupled with excessive dryness and can be described as cold and arid. There are two distinct seasons; a long extended winter starting from October till May and a short summer sets in between June and September. The peak of the winter season is between December and March when most of the water bodies remain frozen. Often the noon temperature goes up to 25 ℃ and occasionally can reach as high as 35 ℃ during the summer season. The temperature drops down considerably during the night and often remains at sub zero degrees Celsius during most months of the year. The average annual rainfall in Changthang is about 100 mm. The precipitation is high during January and February in the form of snow and during July and August in the form of rainfall. One of the striking features of Changthang is the presence of high altitude wetlands amidst cold desert. Most of the wetlands are of glacial origin and remain frozen from December to March. There are more than 20 sizable wetlands within the landscape of Changthang. The size of these wetlands varies from as small as one hectare to as large as 120 km^2. There are numerous other small wetlands scattered over the area. With very limited options for agriculture in Changthang, livestock rearing for Pashmina is the major source of income for the local nomadic community. The local nomads called Changpas, keep moving from one place to another in search of pastures and practice Bhuddhism.

The other study sites are located in the north-east of India. Lhonak valley and nearby wetlands in Sikkim are situated at N27°55′23″, E 88°24′55″ in contiguity with the Tibetan Plateau of the Tibetan Autonomous Region of China. With its altitude ranging from 4,260 to 7,459 m, the valley extends approximately over an area of 5,000 ha and has temperature varying from –30 ℃ to 30 ℃. The other study site**,** Sangti valley is located at

Received: 29 November 2014; Accepted: 3 December 2014

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N27°24′27″ and E92°17′15″ at an altitude of 1,830 m about 15 kilometres from Dirang (on the Bomdila–Tawang highway) in the West Kemeng district of northeast India. The climate is typically montane, the main features of which are sharp contrasts between sun and shade temperatures, a wide diurnal temperature range, inversion of temperature and variability of rainfall depending upon exposure and elevation. Summer is warm and wet, while winter is cold and dry, with occasional rain. Annual rainfall varies from < 1,500 mm (northern slopes, partly rainshadow zone) to > 2,000 mm (southern slopes). The temperature generally ranges from its minimum value of 0 ℃ in winter to its maximum value of 30 ℃ in summer. The western side of the valley has villages inhabited by the Monpa community which practices Buddhism and its members are also followers of the ancient animist tradition. Agriculture is one of the occupations practiced by the villagers, in which most agriculturalists grow paddy and maize. In winters, the harvested paddy fields attract many species of birds. Another study site, Pangchen valley of Zemithang is situated at N27°42′50″ and E91°43′37″ at an altitude of 2,115 m in Tawang. The main valley is 1.5 km long and 0.5 km wide. Annually, temperature may vary from a low of –4 ℃ in the month of January to a high of 25 ℃ in the month of September and receives > 1,500 mm of rainfall annually. Owing to altitudinal variation from 2,000 to >5,000 m, the forest cover varies from temperate conifer and broadleaf to subalpine and Alpine scrub.

Methods

A thorough review of all the published literature on the Black-necked Crane in India was done. The surveys were planned for all the previously known and likely sites where the Black-necked Crane can be sighted. Data on status and distribution of the Black-necked Crane were collected between 2000 and 2014. At all the previously known valleys and wetlands, cranes were systematically searched through vehicle as well as on foot. The surveys were divided into two parts to document the breeding and wintering populations. In order to document the breeding population**,** surveys were conducted from March to November of a particular year and the wintering populations were recorded during surveys from November to March of a particular winter season. At the onset of breeding season, regular surveys were conducted each year between March and November. All motorable roads and vantage points along each transect were used to research the cranes through spotscope/ binoculars. Once cranes were sighted**,** data on date, time, flock size and breeding status was recorded. Also the location of sighting was recorded using a Garmin GPS. Weekly surveys were conducted between March and April to ascertain the arrival date of the breeding Black-necked Cranes at different locations within the study area. Similarly, surveys were conducted during October and November to record the departure dates of the Black-necked Crane from breeding areas to their wintering grounds. Whenever a crane was sighted at a particular location for the first time during a particular year, it was considered the arrival date. At places wherever locals were present, they were also interviewed and if information was found to be reliable, the reported date was considered as the date of arrival. Similarly the last date when a crane was sighted at a particular location, it was considered as its departure date or as reliably reported by the locals. Similar techniques were used at the wintering areas to document the arrival and departure dates of the wintering population. Each previously marked location/ territory was thoroughly searched for presence of the Black-necked Crane. In order to avoid any confusion in the data, sub-adults were also included in the category of adults. Data on the highest number of cranes recorded during a particular time of the year has been used.

RESULTS

Status and distribution of breeding population of the Black-necked Crane in India

Existence of the Black-necked Crane in the Changthang region of India has been known to the Changpa nomads since time immemorial. However, the first scientific record of the species was of Ludlow (1920), who saw three cranes in Tsokar on 2nd June 1919 and shot one for identification. Since then, several workers have studied different aspects of the Black-necked Crane in the Changthang landscape (Table 1). We initiated yearly surveys of counting cranes on their breeding grounds in May 2000 and the same was continued until October 2014. The Black-necked Cranes in Changthang start arriving in the last week of March and late comers do not reach the area until the end of April. Each year, we conducted three systematic surveys searching for cranes in the wetlands of Changthang, counting their numbers and recording breeding status. Each year the first survey was conducted in May, second in August and the last in October, just before the

departure of the cranes from Changthang. In the following sections we have summarized the status of the breeding population of the Black-necked Cranes at different wetlands of Changthang by compiling the earlier records along with our own data collected between 2000 and 2014 (Table 2).

Table 1 Historical record of Black-necked Cranes in Ladakh

S. No.	Month / Year	Number of Black-necked Cranes		No. of locations/ wetlands covered	Reference
		Total sightings	Breeding pairs		
1	June 1919	3	1	2	Ludlow, 1920
2	June 1924	11	4	7	Osmaston, 1925
3	May–June 1926	10	5	8	Meinertzhagen, 1927
4	June 1976	5	2	4	Hussain, 1976
5	July 1978	12	1	10	Gole, 1981
6	May–June 1980	14	3	10	Gole, 1983
7	June 1982	13	3	9	Nurbu, 1983
8	June 1983	7	2	6	Hussain, 1985
9	Aug–Oct 1986	16	2	8	Narayan et al, 1987
10	July–Nov 1987	9	1	5	Akhtar, 1989
11	Sep–Oct 1992	17	4	14	Chacko, 1992
12	May–Sep 1995	22	5	18	Chacko, 1995
13	May–Aug 1996	25	12	18	Chacko, 1996
14	June–Sep 1997	38	12	18	Pfister, 1998

Table 2 Status of Black-necked Cranes observed in Ladakh during the present study

S. No.	Month / Year	Number of Black-necked Cranes				No. of locations/ wetlands covered
		Total sightings	Breeding pairs	Total no. of adults	Total no. of chicks fledged	
1	May–Oct 2000	32	9	28	4	14
2	Apr–Oct 2001	41	10	38	3	16
3	Apr–Dec 2002	59	15	52	7	22
4	Mar–Nov 2003	60	16	50	10	22
5	Apr–Nov 2004	64	15	51	13	22
6	Apr–Nov 2005	58	15	48	10	22
7	Apr–Nov 2006	59	15	46	13	22
8	Mar–Nov 2007	58	16	47	11	22
9	Apr–Nov 2008	81	15	68	13	22
10	Apr–Nov 2009	65	15	56	9	22
11	Apr–Nov 2010	73	12	62	11	22
12	Mar–Nov 2011	79	14	72	7	22
13	Apr–Nov 2012	139	14	128	11	22
14	Apr–Nov 2013	114	15	99	15	22
15	Mar–Oct 2014	112	17	104	8	22

Status and distribution of the breeding population of the Black-necked Crane at Tsomoriri

The earliest published account on occurrence of the Black-necked Crane at Tsomoriri was of Osmaston (1925) who sighted two cranes. Meinertzhagen (1927), also visited several wetlands including Tsomoriri but failed to establish a presence of the Black-necked Crane at this site. About half a century later, a team consisting of naturalists and scientists from the Bombay Natural History Society, WWF–India and Zoological survey of India also conducted a survey at Tsomoriri apart from several other areas of Ladakh, in search of the Black-necked Crane (Gole, 1980), however, they also did not see any cranes at this site. Others, such as Hussain (1976, 1985) and Gole (1981) also carried out surveys at several wetlands of Changthang but none of them reported seeing the Black-necked Crane at Tsomoriri. Pfister (2001) on the basis of surveys conducted during 1994 and 1997 summarised the presence of cranes and their breeding status at different wetlands**,** however, did not record the Black-necked Crane at Tsomoriri. Mishra and Humbert-Droz (1998) recorded three cranes at the Nuro Sumdo wetland adjoining Tsomoriri.

During this study we recorded the presence of a pair at Tsomoriri for two consecutive years (2000, 2001). After a gap in 2002, a pair of cranes was again recorded continuously for three years. During the last six years (between 2006 and 2012), one pair of Black-necked

Cranes was regularly sighted in 2008, 2011 and 2012. In 2013 although the whole wetland was surveyed, no Black-necked Cranes were sighted. In 2014 a pair nested and successfully raised a chick on the marshes in the southern side of the wetland. This is the first nesting record from the southern side of the wetland.

During a period of 15 years, cranes used this wetland during breeding season almost every year and in 2000 a pair constructed a nest and laid eggs thus confirming Tsomoriri as an occasional breeding ground. It was the first ever record of breeding Black-necked Cranes at this wetland. The nesting of a pair on the southern side of the wetland in 2014 confirms that Tsomoriri is still a good breeding habitat for the Black-necked Crane in Ladakh.

Status and distribution of a breeding population of Black-necked Cranes at Tsokar Basin

As mentioned earlier the first record of the Black-necked Crane's occurrence on Changthang plateau within Indian limits was of Ludlow (1920) who discovered the species in Ladakh on 2nd June 1919 at Tsokar. Osmaston (1925) reported occurrence of three cranes at Tsokar which he observed in June 1924, while Meinertzhagen (1927) recorded four cranes from the area. After a gap of about five and a half decades, Nurbu (1983) reported the presence of two cranes in June 1982. Col. R.T. Chacko, carried out surveys in 1992 (Chacko, 1993), 1995 and 1997, and recorded two, three and four cranes respectively (Chacko, 1995; Chacko, 1997, Unpublished data). Pfister (1998) reported occurrence of three cranes each in 1995 and 1996 and four in 1997 along with one nest each in 1996 and 1997.

We visited Tsokar Basin which also includes nearby Startasapuk Tso in the first week of April 2000 and observed a pair of cranes near Thukjay (Ralay) village moving on the snow on a half frozen lake. During the scheduled survey after a month, we visited the area in May and located a nest at the edge of Tsokar Lake, where crane was incubating the eggs. It was the first record of the presence of a nest at Tsokar. However, based on the sighting of chicks in earlier years, the area was known as one of the breeding grounds of cranes. Unlike Tsomoriri, the Black-necked Crane visited Tsokar Basin all through the study period with fluctuating numbers. Between 2001 and 2004, two pairs of cranes each at Startsapuk Tso and Tsokar regularly spent the summer. In 2005 the number of cranes increased to seven and next year to nine until 2007. In 2008, an unusually large flock comprising of 23 individuals arrived at Tsokar Basin in June and stayed there until the end of August. Four pairs of cranes including two breeding pairs remained in the area for the rest of the summer period. In 2009, only 11 cranes were seen in the area with one nest at Tsokar. During 2010 and 2011 the numbers dropped once again and only seven and eight cranes were observed respectively. In 2012, 25 Black-necked Cranes including two breeding pairs with three chicks were recorded at Tsokar Basin. In 2013, 15 Black-necked Cranes including one breeding pair with two chicks were sighted. As per our latest survey in 2014, we recorded 15 cranes with three breeding pairs and two chicks at Tsokar Basin.

Status and distribution of the breeding population of Black-necked Cranes at Puga valley

Marshes in this valley are known for the presence of cranes since the time of Meinertzhagen (1927) who visited the valley in June and observed a pair of cranes. Afterwards, Pfister (1998) reported the occurrence of a pair in the Puga marshes. We carried out the first survey in Puga valley in 2001 and found a pair of cranes during May. At subsequent surveys of the valley during August, a nest was located in a marsh, nearly at the centre of the valley. There were six cranes in 2002 while in 2003 only four cranes were recorded. In subsequent years until 2012, the number of cranes visiting the valley fluctuated between a minimum of two and maximum of five individuals. In 2013 only one pair was recorded and in 2014, two pairs were recorded here which included a breeding pair. Except for 2001, 2012 and 2014 cranes did not breed in this valley during other years of observation.

Status and distribution of the breeding population of Black-necked Cranes at Lam Tso–Chumur

Earlier than the present study, occurrence of the Black-necked Cranes at Lam Tso–Chumur was reported by Gole (1983). He observed a pair of cranes along with a nest while conducting surveys in 1980. Chacko (1996, unpublished data) reported 3 cranes and one nest. Pfister (1998) on the basis of studies carried out between 1995 and 1998, reported occurrence of three cranes each in 1995 and 1996 and four in 1997. He also reported the presence of a nest in the Lam Tso area during his three years of observations.

During our studies, we conducted the first survey of this wetland in 2002 and observed one pair of Black-necked Cranes but no nest. In 2003, again only one pair was recorded, but this time it nested in the area. We

visited Lam Tso in November 2003 and again observed the pair while at other places, the cranes had left their summer habitat. In order to confirm its status, we again visited in December 2003 and January 2004 and found the pair moving on the completely frozen wetland. We could not visit the area in February, but at the end of March the pair was observed again. This is probably the first record of a pair that has spent the winter in Changthang. In subsequent years as well the pair was found during winter months at Lam Tso-Chumur area until 2010. In 2003, three cranes were observed during the breeding season at Lam Tso, while during rest of the study period of ten years (2002−2012) only one pair was found in this area. In 2013 one pair was recorded at this site while in 2014 no cranes were sighted.

Status and distribution of the breeding population of the Black-necked Crane at Hanle

At Hanle marshes, Hussain (1976), for the first time reported the occurrence of a pair and a nest. Gole (1983) also reported presence of one pair of cranes and a nest in 1980, however, he observed only a single adult in 1982. In June 1983, a pair of Black-necked Cranes was reported to be present at Hanle (Hussain, 1985). Narayan et al (1987) conducted a survey between August and October 1986 and reported one pair and a nest. Chacko (1995, unpublished data) reported occurrence of four and seven cranes during the summers of 1992 and 1995 respectively and six cranes and three nests in 1996 (Chacko, 1996, unpublished data). He also described the locations of the nests at Hanle plain. One of the nests was located at the north of Hanle in the Jung Demo area, another at the centre of Hanle at Raar while the third, between Shado and Bug villages near Hanle River in the south. Pfister (1998) reported the presence of nine cranes and three nests in 1997 at Hanle.

We surveyed Hanle plains between 2002 and 2014. The number of cranes at Hanle remained more or less consistent during the period of the study ranging from 8 to 19 barring 2009 when only six individuals were recorded. In addition to the earlier reported nests, a fourth nest was located at Chukil Coma, near Hanle monastery in the vicinity of a stream coming from Tashi Choling Nunnery in 2002. Nesting at Chukil Coma was again recorded in 2003 but afterwards the site was probably abandoned as nesting at this site was not recorded until 2014. In 2013, 19 Black-necked Cranes including one breeding pair were recorded at Hanle. In 2014 only nine birds were recorded here and no breeding pair was recorded.

Status and distribution of the breeding population of Black-necked Crane at Mankhang/Lalpahari

Occurrence of Black-necked Cranes at Mankhang was reported by Gole (1981, 1983), Nurbu (1983), Hussain (1985) and Pfister (1998). All of them reported either a single crane or a pair. During the present study, for the first time, we visited Mankhang in 2002 and since then until 2014 we consistently observed one breeding pair in the area.

Status and distribution of the breeding population of Black-necked Cranes at Staklung

Occurrence of a pair of Black-necked Cranes was reported at this site in 1986 by Narayan et al (1987), two and four individuals in 1992 and 1995 respectively by Chacko (1992; 1995, unpublished data). Pfister (1998) reported occurrence of three individuals between May and September, 1997. All the above researchers have confirmed the presence of cranes at Staklung but did not report nesting. During our surveys, we observed a pair regularly breeding at Staklung between 2002 and 2009 while the numbers doubled in 2010 and 2011. During the first survey in 2002, we located one nest in an open marsh close to Staklung stream and until 2014 nesting took place regularly barring 2010 and 2013.

Status and distribution of the breeding population of Black-necked Cranes at Yaya Tso

The first ever assessment of the crane population at Yaya Tso was carried out during the present study. In May 2002, while conducting the survey at this wetland, a pair of Black-necked Cranes was observed establishing its breeding territory in the marsh on the eastern side of the lake. In June, the pair built a nest at a mound almost in the centre of a pond and earned the distinction of being the highest nesting site of the Black-necked Crane in Changthang at an altitude of 4,820m above mean sea level. The pair was observed regularly nesting at Yaya Tso from 2002 until 2014.

Status and distribution of the breeding population of Black-necked Crane at Loma

Loma marshes are located along the road that connects Loma and Hanle and hence it was easier to scan the area thoroughly. Regular surveys were conducted from 2002 onwards, however, Black-necked Cranes could not be found until 2010. During the first week of

June 2010 a nest was recorded on a mound in the middle of a small pool. A pair of Black-necked Cranes was also observed in 2011 but nesting did not occur. Similarly two pairs were recorded in 2012. During surveys in 2013 and 2014 only one non-breeding pair was recorded each year.

Status and distribution of the breeding population of Black-necked Crane at Dungti

During the 2002 survey in May, a pair of Black-necked Cranes was located in a marsh along the road. The pair was occupied with courtship displays and it was believed that the pair might nest in the area. However, during subsequent surveys in August and October, the cranes were not seen. Similarly, in 2003 and 2004 a pair was located in the last week of April/May but could not be sighted at later surveys. From 2005 to 2009 we could not find any cranes at Dungti. However, in 2010 and 2011 four and six cranes were located in the marshy areas. In both the years, cranes spent the summer months at the wetland but did not nest. In 2012, 18 cranes were recorded here which is the highest number ever recorded at this site during a particular year. In 2013 only four cranes were recorded at this site while in 2014, seven cranes were recorded in this area which included a breeding pair. The nesting in 2014 is the first nesting record from Dungti.

Status and distribution of the breeding population of Black-necked Crane at Fukche

In the reverine marshes of Fukche, the occurrence of a pair of Black-necked Cranes was reported by Meinertzhagen (1927), Gole (1981) and Nurbu (1983). Chacko (1995, 1996, unpublished data) reported the occurrence of four cranes in 1992 and two each in 1995 and 1996. In later years, he also located one nest. Pfister (1998) located four cranes and two nests in 1997. The status of the Black-necked Crane at Fuckche until 2010 remained the same during the present study as reported by Pfister (1998). Between 2002 and 2009, four cranes were observed each year except in 2004 when the number of cranes visiting Fuckche was six. After a gap of six years in 2010, again we observed six cranes in the area. In 2011 and 2012, the number of cranes at Fukche rose to ten and twenty individuals respectively. Two nests were located in the area in 2002 and nesting was observed at these sites regularly between 2002 and 2009. During 2010 cranes did not nest in the area. However during the last four years of the study nesting was recorded in the area with one nest in 2011, two nests in 2012 and one nest in 2013. In 2013, seven cranes including a breeding pair were recorded. No nesting was recorded at Fukche in 2014, while the total number of cranes sighted here in 2014 was fifteen. This is the highest number of cranes recorded during any year at Fukche.

Status and distribution of the breeding population of Black-necked Cranes at Chushul marshes

Chushul is one of the most frequently visited areas for observing Black-necked Cranes. The earliest record of an occurrence of Black-necked Cranes in this area is of Osmaston (1925), who sighted six cranes in 1924. Meinertzhagen (1927) reported the presence of four cranes in May 1926. After about half a century later, Hussain (1976) reported three cranes which he located in June 1976. Gole (1981, 1983) reported the occurrence of two cranes in 1978 and three in 1980 while Nurbu (1983) located a pair in 1980. Other researchers who reported the occurrence of cranes in Chushul include Narayan et al (1987) fourteen cranes in 1996, Akhtar (1989) four in 1987, Chacko (1992), five in 1992 and six each in 1995 and 1996 (Chacko, 1995; 1996, unpublished data) and Pfister (1998) ten cranes in 1997. Chuchul is one of the main breeding areas of Black-necked Cranes in Changthang. Regular nesting has been observed since 1976 as mentioned in the above referred studies.

During the present study, 12 cranes were located in 2002 with three nests; one each at Tsigul Tso, Tsonayak and Jamarding marshes at Chushul valley. The number of cranes at Chushul varied in different years but nesting took place more or less regularly at all three sites. The maximum number of cranes (18 individuals) was observed in 2014 and fifteen in 2010 and 2011. In 2012, fourteen cranes were recorded at this site. Between 2003 and 2008 the number cranes remained at either six or eight. In 2013, twelve cranes were recorded including a breeding pair. The population of eighteen cranes recorded in 2014 included three breeding pairs.

Status and distribution of the breeding population of Black-necked Cranes at Lungparma

Lungparma valley was explored by Nurbu (1983) while documenting the status of Black-necked Cranes in Ladakh. He reported the occurrence of a pair in the valley. Pfister (1998) reported occurrence of a pair, which he observed in 1997 along with a nest.

During the present study, a pair of cranes was regularly observed between 2002 and 2009, except in 2003, when three cranes visited the area. During 2010

and 2011, the presence of four cranes was recorded. One nest was located on a grassy mound surrounded by water in the middle of a small pool. The number of cranes recorded at this site increased to eight in 2012. In 2013, nine cranes were recorded here including a breeding pair. In 2014 for the first time two nests of Black-necked Cranes were recorded at Lungparma marshes at a distance of about 1 km. from each other. The total number of cranes recorded at Lungparma in 2014 was eight. Nesting occurred at this site continuously all through the study period.

Status and distribution of the breeding population of Black-necked Cranes at Harong marshes

Harong marshes are a recently discovered breeding area of the Black-necked Crane in Ladakh. Probably Chacko (1995, unpublished data) made the first attempt to locate cranes in the area. In 1995, he observed three cranes and again in 1996, three cranes and a nest. Pfister (1998) reported four cranes and a nest in 1997. Between 2002 and 2011 two and five cranes were located each year except 2010 and 2011. In 2009 a Black-necked Crane nest was also recorded here. In 2012 and 2013 only a single pair was sighted in the area. In 2014 a breeding pair with a nest was recorded at Harong marshes.

Status and distribution of the breeding population of the Black-necked Cranes at Pangong Tso

There is no earlier scientific record of occurrence of Black-necked Cranes at Pangong Tso though this lake is a frequently visited tourist destination. The first survey of the lake was carried out in 2002 and a pair of Black-necked Cranes was seen in the Lukung area. In subsequent surveys between 2003 and 2011, the occurrence of only one pair was recorded except 2005 when three individuals were observed. During the surveys in 2012 two pairs of cranes were sighted feeding occasionally in the marshes near Thakung. During our surveys in 2008, 2013 and 2014 cranes were not sighted at this location.

Status and distribution of the breeding population of Black-necked Cranes at wetlands of Sikkim

There are very few records of Black-necked Cranes in Sikkim. The breeding of a Black-necked Crane from Lhonak valley in north Sikkim was recorded in July 1991 (Ganguli-Lachungpa, 1998). In the latter years a pair of Black-necked Cranes has been occasionally sighted here during the breeding season until 1996 (Ganguli-Lachungpa, 1998). In 2010 our team visited wetlands near this valley and recorded a pair at Yum Tso (Ghose et al, 2012). In 2013 one pair was again sighted at this wetland (Table 3). This confirms that a pair of Black-necked Cranes regulary visit wetlands near Lhonak valley of Sikkim during the breeding season. If the crane habitat in this area is protected then there is the possibility that this site will have more cranes in the future during the breeding season.

Table 3 Observation of the Black-necked Crane in Sikkim

S. No.	Month / Year	Number of Black-necked Cranes		Location/ wetland	Reference
		Total sightings	Breeding pairs		
1	July 1991	2	1	Thepley Tso	Ganguli-Lachungpa, 1998
2	July 1992	3	1	Muguthang	Ganguli-Lachungpa, 1998
3	May 1996	3	–	Muguthang	Ganguli-Lachungpa, 1998
4	June 2010	2	–	Yum Tso	Ghose et al, 2012
5	2011	–	–	–	–
6	2012	–	–	–	–
7	2013	2	–	Yum Tso	Present study

Status and distribution of the wintering population of Black-necked Cranes in India

In India a small wintering population used to visit Apatani valley of northeast India. Probably the earliest record of this population is by Betts (1955). He reported a flock of 27 individuals inhabiting the valley. Based on the information from the local villagers he has further described that these numbers were constant during those years. Khacher (1981) could not find any crane during the survey of the valley. On the basis of information collected by locals, it was known that the last pair of wintering cranes was hunted by tribes two years ago (that means some time in 1979). This led to the presumption that the population wintering in Apatani was extinct. Gole (1990) visited Apatani and Sangti valleys and rediscovered two Black-necked Cranes in Sangti valley while he could not find any in Apatani. Singh (2000) reported yearly counts of cranes visiting Sangti valley between 1992 and 1999. Maximum numbers of wintering cranes (six individuals) in the valley were

recorded in 1994. In rest of the years the number varied between one and three individuals (Table 4). During the present study the whole Apatani valley was surveyed in winter months of 2005–2006 and 2006–2007. No signs of the presence of these birds were found. However, the survey team successfully located a flock of 11 individuals (all adult cranes) in Sangti valley in a paddy field in the vicinity of Govt. Middle School, Sangti. Another unknown wintering area was discovered in 2010 in Pangchen valley of Zimithang area, located close to Sangti valley where three adults were recorded. Later, in 2011, some locals who were educated about the cranes by the efforts of team members, reported a flock of seven cranes (six adults and one juvenile) from the area. This clearly indicates that cranes have abandoned the Apatani valley mainly due to increasing disturbance after the establishment of two new townships, Zero and Hapoli and possession of firearms by locals and found new areas as their wintering grounds. It is also possible that some other areas still not identified may be occupied by cranes. Currently Pangchen valley of Zemithang and Sangti Valley are the only valleys in India where a small wintering population of Black-necked Cranes is found. Recent records of Black-necked Cranes in northeast India have been presented in Table 5.

Table 4 Historical record of Black-necked Crane in northeast India

S. No.	Year	Total sightings	Location	Reference
1	1946–1947	27	Apatani	Betts, 1954
2	1990	2	Sangti	Awati, 1994
3	1991–1992	3	Sangti	Singh, 2000
4	1992–1993	1	Sangti	Singh, 2000; Awati, 1994
5	1993 –1994	6	Sangti	Singh, 2000; Awati, 1994
6	1994 –1995	3	Sangti	Singh, 2000
7	1995–1996	1	Sangti	Singh, 2000
8	1996 –1997	1	Sangti	Singh, 2000
9	1997 –1998	0	Sangti	Singh, 2000
10	1998–1999	3	Sangti	Singh, 2000

DISCUSSION

There exists a wide information gap on the status and distribution of the Black-necked Crane in India. To bridge this information gap, the present study has focused on long term monitoring of the species so that a clear picture on the overall status and distribution of the species in India can emerge. In 2012 a total of one hundred and thirty nine Black-necked Cranes and in 2014 a total of one hundred and twelve Black-necked Cranes were recorded in the breeding areas in Ladakh**.** This is much higher than the thirty eight birds recorded by Pfister (1998). The increase in the population of cranes is mainly because of the coverage of much larger areas during different months of a particular year. Also the population of Black-necked Cranes in many areas within the distribution range of the species is showing an increasing trend (Bishop et al, 2012, Harris & Mirande, 2013, Farrington & Zhang, 2013). This increase in the population can also be attributed to the increased awareness about the species and protection measures at many key areas. A total of 22 breeding sites were identified in Ladakh during the study period. This is contrary to the earlier 12 breeding sites as recorded by Pfister (1998). The increase in the number of breeding sites is mainly because of the coverage of a much larger area during every study year and also because of the increasing trends seen in the overall population of the species. New breeding sites such as Tsomoriri 1, Tsomoriri 2, Yaya Tso, Tsokar 2, Tsokar 3, Hanle 4, Nyoma, Dungti, Mankhang 2, Fukche 3 & Loma were identified during the course of study.

Table 5 Status of Black-necked Crane observed in Sangti & Zemithang valleys during the present study

S. No.	Year	Total sightings	Location
1	2005–2006	11	Sangti
2	2006–2007	6	Sangti
3	2007–2008	4	Sangti
4	2008–2009	-	Sangti
5	2009–2010	3	Zemithang
6	2010–2011	7	Zemithang
7	2011–2012	4	Zemithang
8	2012–2013	2	Zemithang
9	2013–2014	5	Zemithang
10	23 Nov 2014	4	Zemithang
11	15 Dec 2014	4	Sangti

The cranes start arriving in Ladakh during last week of March and the first week of May with the majority arriving in the first half of April. They start departing during the last week of October and it continues until the first week of November. However, Pfister (1998) reported the arrival of cranes in their breeding grounds from late April to early May and departures from mid-October to November. The differences in the arrival and

departure times may be attributed to the short term observations of Pfister, restricted only to one breeding season. Consistent with the present study Dehao (1987), Dwyer et al (1992), Bishop (1996) and Farrington & Zhang (2013) reported the arrival of Black-necked Cranes at their breeding grounds in China starting from late March to mid-May and departure in mid-October through November. This similarity in the arrival and departure of cranes in India and China is due to the fact that Ladakh is part of the same eco-region. The arrival in Ladakh was followed by courtship and mating which was frequently performed during the months of April and May. In most of the cases the courtship and mating was recorded during early morning, on very few occasions at mid-day and in the evening. This is similar to the observations made during various other studies conducted on the breeding behavior of Black-necked Cranes in China (Dehao et al, 1991; Dwyer et al, 1992; Yang et al, 2007).

While the breeding population in Ladakh in India is showing an increasing trend, the numbers of cranes visiting Sikkim during the breeding season are very small and this calls for more regular surveys in Sikkim. The wintering population in India as shown in Table 4 and Table 5 is almost at the verge of extinction. The disappearance of Black-necked Cranes from Apatani valley in northeast India is attributed to habitat loss, degradation and poaching (Choudhury, 2002). These findings were confirmed during the present study as well as at present Apatani valley is densely populated and locals still move in the area with firearms. At present many threats still persist in its breeding as well as its wintering range. Changing land use patterns coupled with a boom in the tourism industry is posing serious threats to the species (Chandan et al, 2006). Since the species shares the same habitat which the nomadic herders use for grazing their livestock, presently excessive grazing practices are another major threat to the species during its breeding season. In Ladakh the dogs owned by nomadic herders and by the armed forces pose a serious threat to successful breeding of these birds. These dogs eat the eggs and chicks of the cranes during breeding season. Fencing of pastures for exclusive use by nomadic communities is another major threat to the species. The presence of high tension wires in the crane habitat is also another threat to the species (Fengshan et al, 2012). Similar threats also exist in Sangti valley where a crane was killed as a result of striking a high tension power line in January 2007. It is therefore recommended that all the high tension wires in crane habitats should be put underground as has been done in Phobjika valley of Bhutan. Due to the prevalence of Buddhist culture in most of the areas where Black-necked Cranes are found in India, this species has been protected by the locals for a long time (Betts, 1955; Chandan et al, 2006; Gole, 1981; Ludlow, 1928; Meinertzhagen, 1927; Nurbu, 1983; Pfister, 1998). Ladakh in western Himalayas and Sangti valley and Pangchen valley of Zemithang in the eastern Himalayas has a majority of Buddhist population and these people still consider cranes as a symbol of good luck and sacredness. During the present study it has been observed that at many locations the Indian Army and ITBP (Indo-Tibetan Border Police) units are helping in the conservation measures for the protection of these birds. These military and paramilitary forces further need to be encouraged so that they can take adequate measures for the protection of these birds. Within Ladakh the highest concentration of birds has been found at Tsokar, Hanle and Chushul Marshes. In Sikkim, a pair still regularly visits Yum Tso and more regular surveys need to be initiated in Sikkim. In other parts of northeast India the birds are currently found only in the Pangchen valley of Zemithang and Sangti valley near Dirang. Further this study has been able to confirm that Changthang in Ladakh is an important breeding ground for the Black-necked Crane in India. With a network of a large number of wetlands in Changthang there is a possibility of having more cranes in this area in near future, provided the ecological integrity of the landscape is properly maintained.

CONCLUSION

In absence of scientific information on the current status and distribution of the Black-necked Crane, particularly in India, a long-term study (between 2000 and 2014) was undertaken to collect information on the status and distribution of the breeding and wintering population of the Black-necked Crane in India. Ladakh and Sikkim are the only known breeding areas for the Black-necked Cranes in India. The total population as per the 2014 survey for Ladakh is 112 which includes 17 breeding pairs. During the 2013 survey in Sikkim only one pair was recorded. As per our latest survey records the total wintering population of Black-necked Cranes in India is between 6 − 8 individuals. In order to secure a bright future for the breeding and the winteringpopulation of the Black-necked Crane in India, efforts should be

made to involve all the key stakeholders to protect these birds in the entire currently known distribution range of the species. In China many areas having Black-necked Cranes have been declared as nature reserves (Farington & Zhang, 2013). To revive the wintering population of the species in eastern Himalayas**,** the Sangti valley and Pangchen valley of Zemithang should be declared as Black-necked Crane nature reserves and measures to maintain the ecological integrity of these areas should be taken on as a priority. In Changthang in Ladakh all the tourism and development activities should be properly regulated especially at the nesting and feeding sites of the cranes.

Acknowledgements: We are grateful to WWF-Netherlands for long term funding support for this project. A very special thanks to Mr. Ravi Singh, Dr. George Archibald, Ms. Esther Blom, Dr. Taej Mundukur, Mr. A. K. Singh, Dr. Sejal Worah, Dr. V. B. Mathur, Dr. Asad R. Rahmani, Maj. Gen. G. D. Bakshi, Mr. A. K. Srivastava, Dr. Parikshit Gautam, Dr. C. M. Seth, Ms. Archana Chatterjee, Dr. Dipankar Ghose, Late Mr. Parkash Gole, Col. R. T. Chacko, Prof. Jamal A. Khan, Dr. Gopi Sundar, Mr. Otto Pfister, Mr. Kiran Rajashekriah, Mr. Saleem-ul-Haq, Mr. Tsering Angchuk and Mr. Intesar Sohail for their help. We are also thankful to Dr. Li Fengshan, Mr. Blaise Humbert-Droz, Mrs. Usha Ganguli-Lachungpa, Mr. Shakeel Ahmed, Mr. Ram Saroop and Mr. Dawa Tsering for their help and assistance.

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